6.1 Exponent Laws

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i) Product Rule (add the powers)

$3^4 3^7 = 3^{4+7} = 3^{11}$

ii) Quotient Rule (subtract the powers)

$\frac{3^7}{3^4} = 3^{7-4} = 3^3$

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Zero Exponent

3. $\frac{3^3}{3^3} = 3^{3-3} = 3^0 = 1$

$5^0 = 1 \quad (-1)^0 = 1 \quad \left(\frac{1}{3}\right)^0 = 1$

$-7^0 = -\frac{7}{7} = -1$

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4) Negative Exponents

$\frac{4^3}{4^6} = 4^{3-6} = 4^{-3} = \frac{1}{4^3}$

$\frac{\cancel{4}\times\cancel{4}\times\cancel{4}}{\cancel{4}\times\cancel{4}\times\cancel{4}\times 4\times 4\times 4} = \frac{1}{4^3}$

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5. Power to a Power Rule (multiply the powers)

$(3^4)^3 \Rightarrow 3^{4\times 3} = 3^{12}$

6.) Power of a Product Rule

$(xy)^3 = x^3y^3$

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7 Power of a Quotient Rule

$\left(\frac{x}{y}\right)^9 = \frac{x^9}{y^9}$

Evaluate

$\left(\frac{2}{3}\right)^2 = \frac{2^2}{3^2} = \frac{4}{9}$

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Key Concepts

- There are six exponent laws for powers with integer exponents.
  - Product Law: $b^m \times b^n = b^{m+n}$
  - Quotient Law: $b^m \div b^n = b^{m-n}, b \neq 0$
  - Power of a Power Law: $(b^m)^n = b^{m \times n}$
  - Power of a Product Law: $(ab)^n = a^n b^n$
  - Zero Exponent Law: $b^0 = 1$
  - Negative Exponent Law: $b^{-n} = \frac{1}{b^n}, b \neq 0$
- The exponent laws are useful for simplifying expressions involving powers.

Exponent Laws Recap

$(-4)^0 = 1$

$-4^0 = -1$

$(3^2)^3 = 3^{2\times 3} = 3^6$

$2^3 \cdot 2^4 = 2^{3+4} = 2^7$

$\left(\frac{4}{7}\right)^{-2} \Rightarrow \left(\frac{7}{4}\right)^2 = \frac{7^2}{4^2} = \frac{49}{16}$

$2^{-3} 4^{-2}$

$= 2^{-3} (2^2)^{-2}$

$= 2^{-3} 2^{-4}$

$= 2^{-3-4}$

$= 2^{-7}$

$= \frac{1}{2^7}$

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Extras

$(x^2 y^1)(x^{-3} y^2)$

$x^{(2+-3)} y^{(1+2)}$

$x^{-1} y^3$

$= \frac{y^3}{x^1}$ $\left(\frac{1}{x^1} \cdot y^3\right)$

$(x^2)^{-3}$

$x^{2 \times -3}$

x^{-6}

$\frac{1}{x^6}$ $x=3$

Substitute and Evaluate

$\frac{1}{3^6}$

$\frac{1}{729}$

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Scientific Notation

$3.1 \times 10^3 \times 2.6 \times 10^9$

$(3.1 \times 2.6) \times 10^{3+9}$

8.06×10^{12}

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